SMD Operations Procedures Manual

8.1.1.39 OPERATION OF THE LHC SHELL WELDING FIXTURE

Text Pages 1 through 13
Attachment(s) 1-4

Hand Processed Changes

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SMD Division Head Date

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1 Purpose and scope

1.1 To provide instruction in the operation of the LHC Shell Welding Fixture located in building 902.

2 Responsibilities

2.1 Only operators who have read this procedure and completed a "Reading Acknowledgement" for this procedure and who have been trained by their supervisor shall perform the tasks described herein. A list of operators is maintained by the Division Training Coordinator and the Technical Supervisor.

2.2 The operator shall complete the traveler associated with the Assembly being produced.

3 Prerequisites

3.1 Training

3.1.1 Operators shall be trained by their supervisor before using this procedure.

3.1.2 Operators shall have read the procedure and completed a "Reading Acknowledgement" form.

3.2 Equipment

3.2.1 Safety glasses with side shields, or goggles.

3.2.2 Compressed Nitrogen Cylinder with regulator capable of settings from 0-250 PSIG

4 Precautions

4.1 Wear eye protection. Operations involve working near air lines, high pressure hydraulic lines, and metal parts under high loads.

4.2 Check that the work area is clear of unauthorized personnel.

4.3 Leaks in the hydraulic system can cause oil to be embedded under personnel's skin. If sprayed with pressurized hydraulic fluid, seek medical attention immediately.

4.4 Leaks in the hydraulic system must be cleaned up immediately, with waste disposed of properly.

4.5 Do not use hydraulic system if leaks are present, or if equipment is degraded.

5 Procedure

5.1 Overview Of The LHC Shell Welding Fixture

5.1.1 The Shell Welding Fixture in Building 902 provides a means for welding upper and lower shells to LHC D1/D2/D3/D4 Cold Masses. Additionally, the fixture can be configured to produce RHIC DX magnets. To accomplish this, the fixture has provisions for loading and holding collared coils, laminations, and shells in the correct orientation. A set of air cylinders contained in the fixture applies pressure directly to the shell to hold the assembly in a tightly packed condition during the welding operation. Additionally, the fixture contains a deflection compensation system which uses an hydraulic cylinder and tension rods attached to the bottom of the fixture. The purpose of the system is to correct any bending of the table caused by the force of the air cylinders acting on the magnets' shell. This insures that the welded assembly is straight within drawing requirements.

5.2 Operator Controls

5.2.1 Control Cart (See attachments 1 & 2)

5.2.1.1 Shop Air Regulator: Adjust to regulate pressure of shop supply air applied to the Ratio Relay.

5.2.1.2 Shop Air Pressure Gage: Display in PSIG of supply pressure applied to the inlet side of the Ratio Relay.

5.2.1.3 Shop Air Valve: Opens /Closes flow of shop air to the Shop Air Regulator.

5.2.1.4 Ratio Relay: This regulator has a supply of regulated shop air and a signal air input equal to one-half the pressure being applied to the Air Cylinder Beam Assembly (pressure side). The output pressure of the ratio relay is an adjustable multiplication of its signal air input pressure. The multiplication factor is set by the adjustment knob and can be read (as a ratio) from the display on the side of the valve. The output pressure of the Ratio Relay is used as the input to the 150:1 multiplication of the hydraulic booster pump. This creates a fixed ratio between the air pressure in the Beam Assembly Cylinders and the hydraulic pressure in the Deflection Compensation System hydraulic Cylinder. See attachment 4 for sample calculation.

5.2.1.5 Air Cylinder Beam Assembly Nitrogen Connection: Provides connection point for regulated nitrogen supply line to: 1) Beam Assembly air cylinders & 2) supply signal pressure to reducing relay. Line is protected by a relief valve set at 250 PSIG.

5.2.1.6 Ratio Relay Pressure Gage: Display in PSIG of air pressure at output of Ratio Relay (input to the Hydraulic Booster Pump). The hydraulic pressure being applied to the Deflection Compensation System Hydraulic Cylinder will be 150 times this value.

5.2.1.7 Hydraulic Booster Pump Pressure Gage: Display in PSIG of the hydraulic pressure on the output side of the Booster Pump. This is the pressure being applied to the Deflection Compensation System Hydraulic Cylinder.

5.2.1.8 Hydraulic Fluid Dump Valve: Opening this valve allows for the dump-off and return of the booster pump output pressure back into the hydraulic fluid reservoir.

5.2.1.9 Reducing Relay: Converts signal pressure from Air Cylinder Beam Assembly to one-half of its value.

5.2.2 Air Cylinder Beam Assembly (See attachment 3)

5.2.2.1 Pressure Side Control Valve & Disconnect: Closes off supply to pressure side of all upper air cylinders. Pressure on the pressure side of the double-acting cylinder will move the holding blocks towards the magnet.

5.2.2.2 Vent Side Control Valve & Disconnect: Closes off supply to vent side of all upper air cylinders. Pressure on the vent side of the double-acting cylinders will move the holding blocks away from the magnet.

5.3 Mechanical Configuration of Fixture

CAUTION

Ensure all pins and cotter pins are properly installed prior to use

NOTE

Reference drawing 25-1776.01-5 for assembly details

5.3.1 The fixture has 3 characteristics which shall be configured for the type of magnet being produced:

- Table Rails Position: Inboard /Outboard (I/O)
- Air Cylinder Bridge Height: Low /High (L/H)
- Beam Support Spacers: Used /Not Used (✓/-)

	Magnet Type				
	D1	**D2**	**D3**	**D4**	**DX**
Table Rails	I	O	I	O	O
Air Cylinder Bridge	L	H	L	H	H
Beam Support Spacers	-	-	-	-	✓

5.4 Initial Set Up of Pneumatics and Hydraulics

5.4.1 On the Air Cylinder Beam Assembly, open vent side control valve and close pressure side control valve.

5.4.2 Connect free end of Nitrogen Supply hose to Air Cylinder Beam Assembly pressure side disconnect.

CAUTION

Failure to set nitrogen pressure to zero prior to connection of nitrogen supply may result in unexpected movement of the air cylinders

5.4.3 Connect regulated nitrogen supply to nitrogen inlet disconnect (see attachment 2). Verify that nitrogen pressure is set to zero prior to connection.

5.4.4 Connect shop air supply to input of Control Cart. Open shop air valve and adjust shop air regulator to 67 PSI.

5.4.5 Connect the high pressure hydraulic line from outlet of the booster pump to the hydraulic cylinder on the Deflection Compensation System.

5.4.6 Verify that the Ratio Relay is set to a signal-to-output setting of approximately **1.9 : 1**. This will result in hydraulic pressure applied to the cylinder of the Deflection Compensation System that is approximately 40 times that of the nitrogen pressure being applied to the Beam Assembly Air Cylinders.

NOTE

This set up of the ratio relay is an initial setting. Final adjustment of the relay to ensure that the magnet is straight within engineering requirements will be done in section 5.6.

5.5 Engaging Beam Assembly Air Cylinders

CAUTION

Make sure that area around Beam Assembly Air Cylinders, holding blocks, and Deflection Compensation System is clear of personnel and objects prior to opening valve.

5.5.1 On control cart, close hydraulic fluid dump valve.

5.5.2 On Air Cylinder Bridge Assembly, open pressure side control valve.

CAUTION

Applying pressure in excess of 250 PSIG to the Beam Assembly Air Cylinders will result in damage to the cylinders

5.5.3 Increase nitrogen supply pressure to Air Cylinder Beam Assembly to pressure specified in Magnet Assembly Procedure.

5.6 Adjusting Deflection Compensation System

5.6.1 Adjustments to table straightness shall be achieved by adjusting the Ratio Relay.

NOTE 1

Straightness requirements shall be obtained from the appropriate Magnet Assembly Procedure and the Cognizant Engineer. The final setting of the Ratio Relay shall be determined by these requirements.

NOTE 2

Increasing the output of the ratio relay will result in increased hydraulic pressure at the Deflection Compensation system This will provide increased counteraction to the bending of the magnet caused by the bridge assembly air cylinders

5.7 De-pressurizing System and Preparing for Removal of Beam Assembly

NOTE

Shop Air may be used in place of Nitrogen to retract cylinders.

5.7.1 Adjust nitrogen supply pressure to zero.

5.7.2 On control cart, close shop air supply valve and open hydraulic fluid dump valve.

CAUTION

To prevent unexpected movement of the air cylinders, make sure vent side valve is closed and nitrogen supply pressure has been adjusted to zero prior to connection of nitrogen supply to vent side disconnect.

5.7.3 Disconnect nitrogen supply hose from Air Cylinder Beam Assembly pressure side disconnect. Leave pressure side control valve open.

5.7.4 Connect nitrogen supply hose (or shop air supply) to vent side disconnect.

CAUTION

Applying pressure in excess of 250 PSIG to the Beam Assembly Air Cylinders will result in damage to the cylinders

5.7.5 Open vent side control valve on beam assembly. Increase pressure gradually until cylinders /holding blocks are completely retracted.

5.7.6 On beam assembly, close vent side control valve and close pressure side control valve. Remove shop air or nitrogen line from beam assembly.

5.7.7 Beam assembly is now ready for removal.

6 Documentation

6.3 Magnet Travelers.

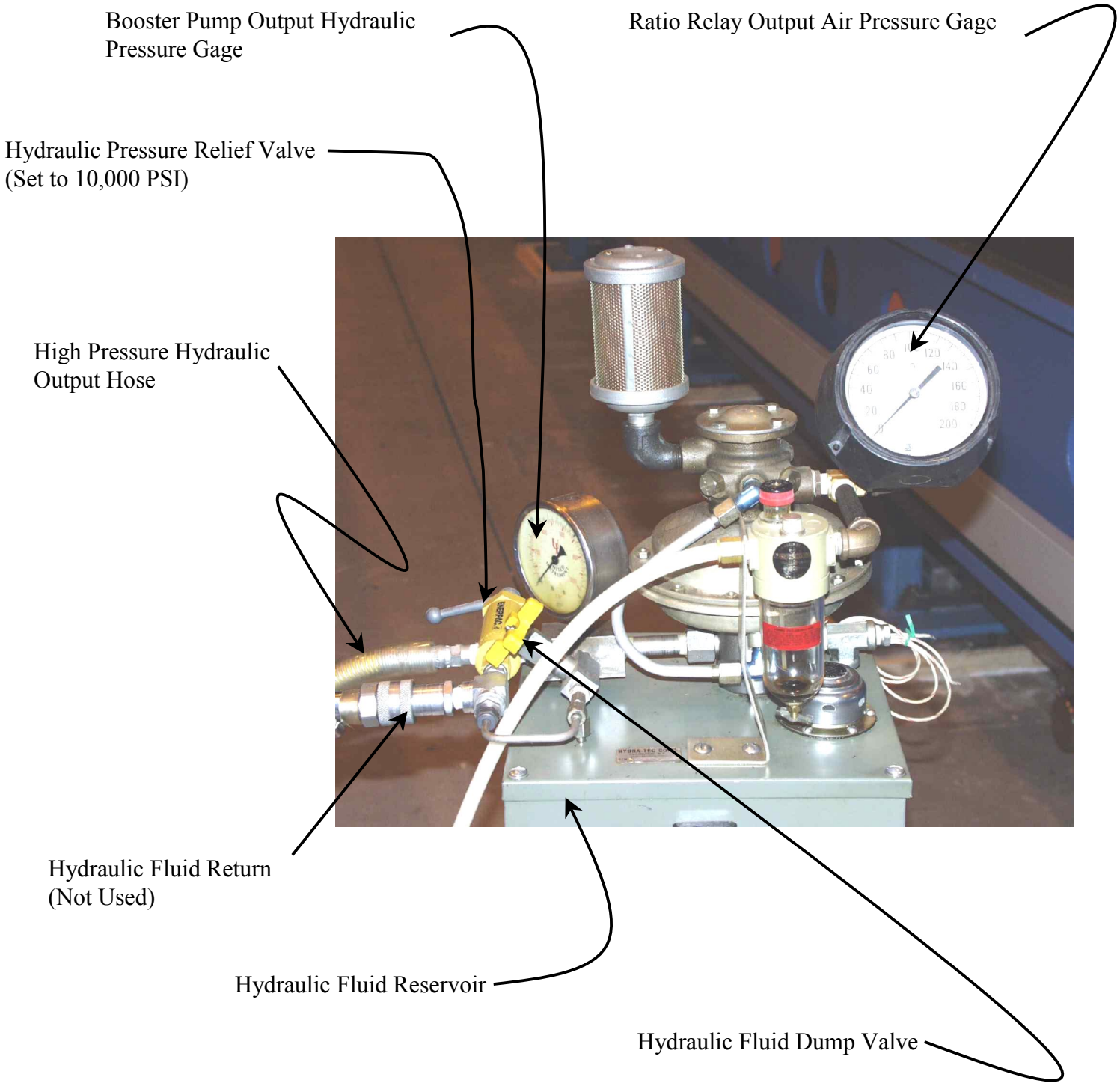
6.4 Magnet Assembly Procedure

7 References

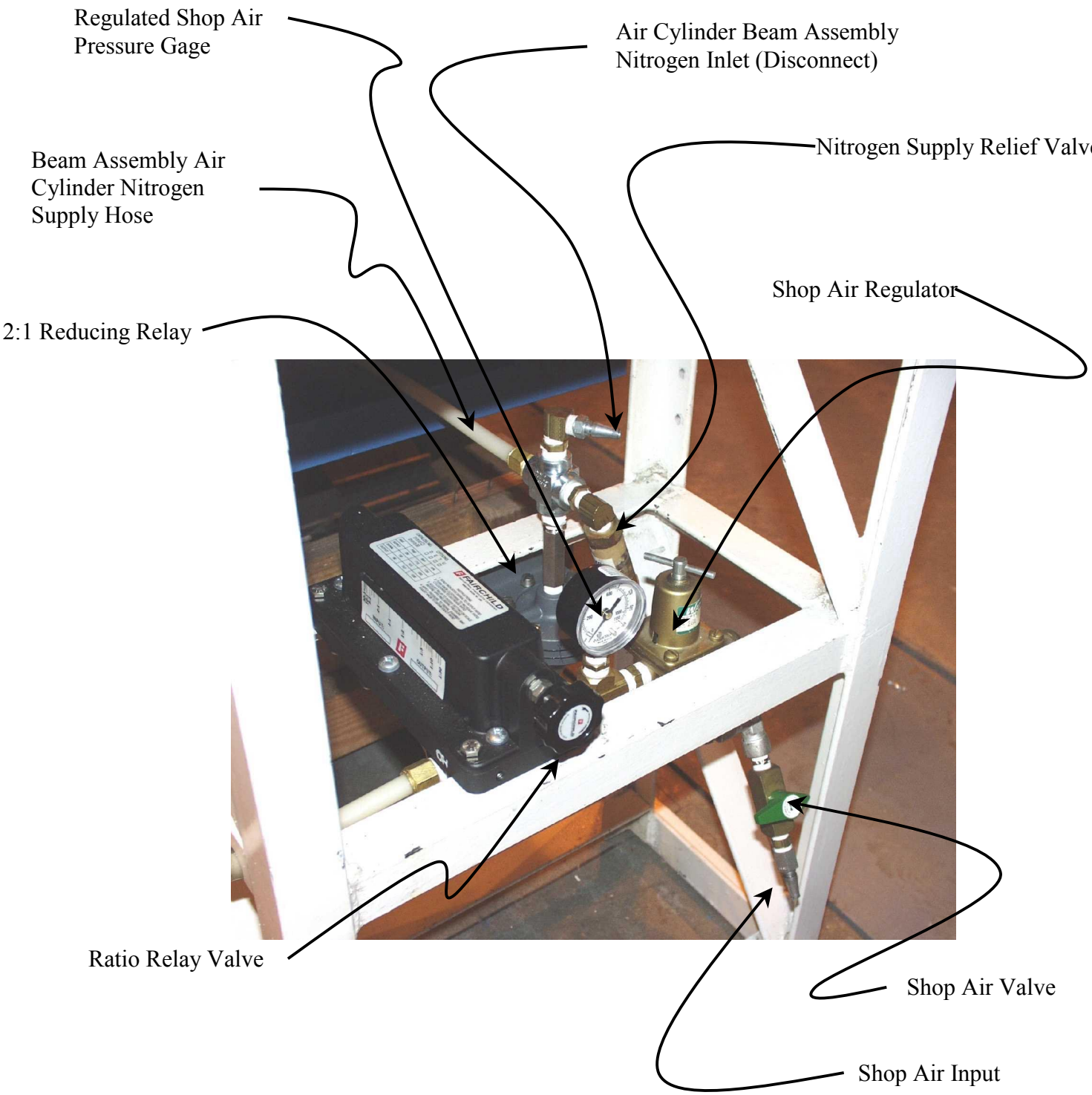
7.3 BNL ES & H Manual 1.4.0 - Compressed Gas Cylinder Safety.

8 Attachments

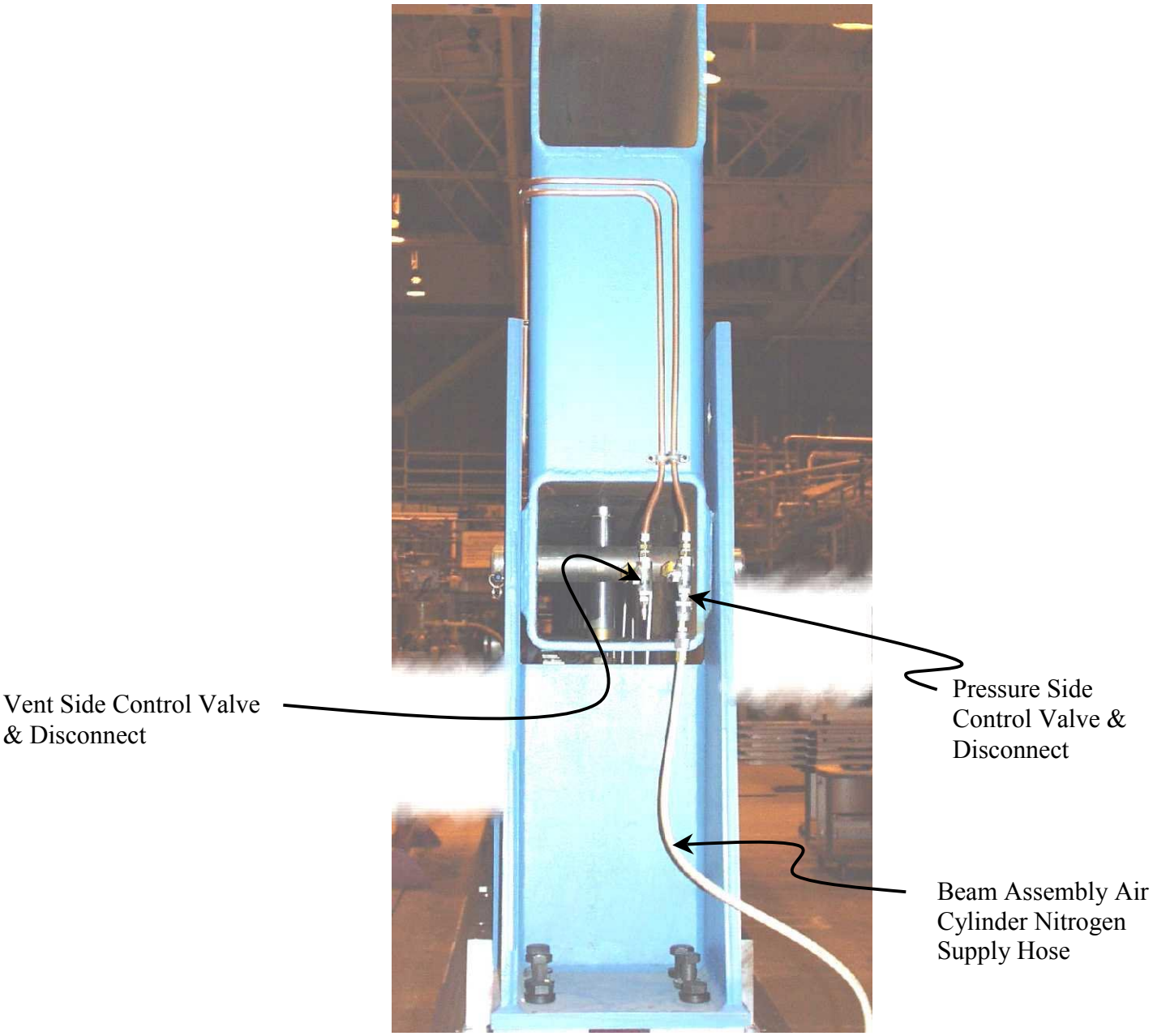
1. Control Cart (upper)
2. Control Cart (lower)
3. Air Cylinder Bridge Assembly
4. Ratio Relay Sample Calculation



Attachment 1 - Control Cart (Upper)



Attachment 2 - Control Cart (Lower)



Attachment 3 - Air Cylinder Beam Assembly

Attachment 4 - Ratio Relay Sample Calculation

Example:

Magnet Production Requirements: 212 PSIG being applied to Beam Assembly Air Cylinders. 8400 PSIG hydraulic pressure desired at Deflection Compensation System Cylinder.

Output of 2:1 reducing relay (which is input of Ratio Relay) is one-half the pressure being applied to the Beam Assembly Air Cylinders: 212 / 2 = 106 PSIG

Required input of Hydraulic Booster Pump (150:1 fixed boost ratio), which is output of Ratio Relay: 8400/150 = 56 PSIG

From above, input of Ratio Relay is 106 PSIG and required output of the Ratio Relay is 56 PSIG: 106/56 = 1.9

→ Signal to Output ratio of Ratio Relay should be set to 1.9 : 1